National Transportation Safety Board

Office of Highway Safety

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594

HWY22MH009

SIGNAL AND HIGHWAY FACTORS GROUP

Group Chair's Factual Report

April 5, 2023

Table of Contents

A. CRASH INFORMATION

Location: Clarendon Hills, Illinois
Date: May 11, 2022
Time: 8:16 a.m. CDT

B. SIGNAL AND HIGHWAY FACTORS GROUP

Group Co-Chairs	Greg Scott, Co-Chair Rail Accident Investigator NTSB - RPH
	Dan Walsh, P.E., Co-Chair General Engineer NTSB - HWY
Group Members	Rex White Rail Safety Specialist Federal Railroad Administration
	Kurt Mullins Director of Research Brotherhood of Railroad Signalmen
	Corey Stethem Director Signals BNSF Railroad
	Paul Youngmark Railroad Safety Specialist Illinois Commerce Commission
	Stan Milewski, P.E. Senior Railroad Safety Specialist Traffic Signal Engineer Illinois Commerce Commission
	Brian Vercruysse, P.E. Rail Safety Program Administrator Illinois Commerce Commission
	Brendan McLaughlin Director of Public Works Village of Clarendon Hills

C. CRASH SUMMARY AND DETAILS OF THE INVESTIGATION

For a summary of the crash, refer to the *Crash Information and Summary Report*, which can be found in the NTSB docket for this investigation.

The report begins with a discussion on prefatory data that includes the crash location, vicinity map, average daily rail volumes, and crash history at the grade crossing. Next, the report provides a discussion on signal factors that includes a description of the signal system, highway-rail grade crossing warning system, and grade crossing regulations and industry standards. The report also provides a discussion on highway factors that includes geometry, signing, and peak hourly volumes near the grade crossing, Village of Clarendon Hills streetscape and paving improvements, vertical drop-off at south end of the grade crossing, tapered joint plan, improvements immediately after the crash, four quad gate conceptual drawing, and the Village of Clarendon Hills designated truck route map and ordinance. Finally, the report concludes with an appendix that lists the attachments and photographs associated with the signal and highway factors investigation.

D. PREFATORY DATA

1.0 Crash Location

Figure 1 is a crash map that illustrates the crash location was approximately 18 miles west-southwest of downtown Chicago.

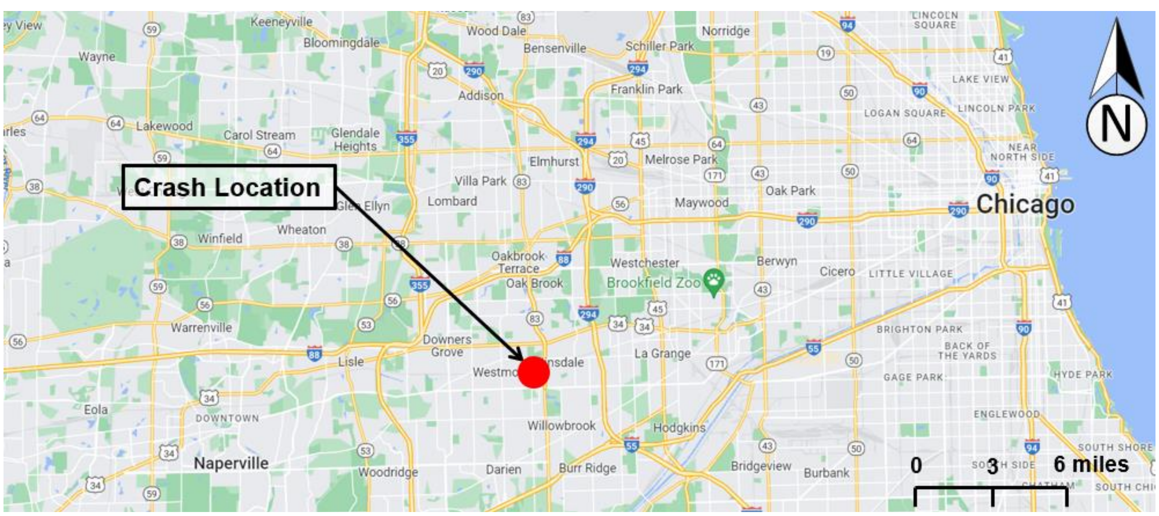

Figure 1 – Crash map (Source: Google Maps revised).

2.0 Vicinity Map

Figure 2 is a vicinity map of the Prospect Avenue and BNSF triple main grade crossing. The crash occurred on Track #3.

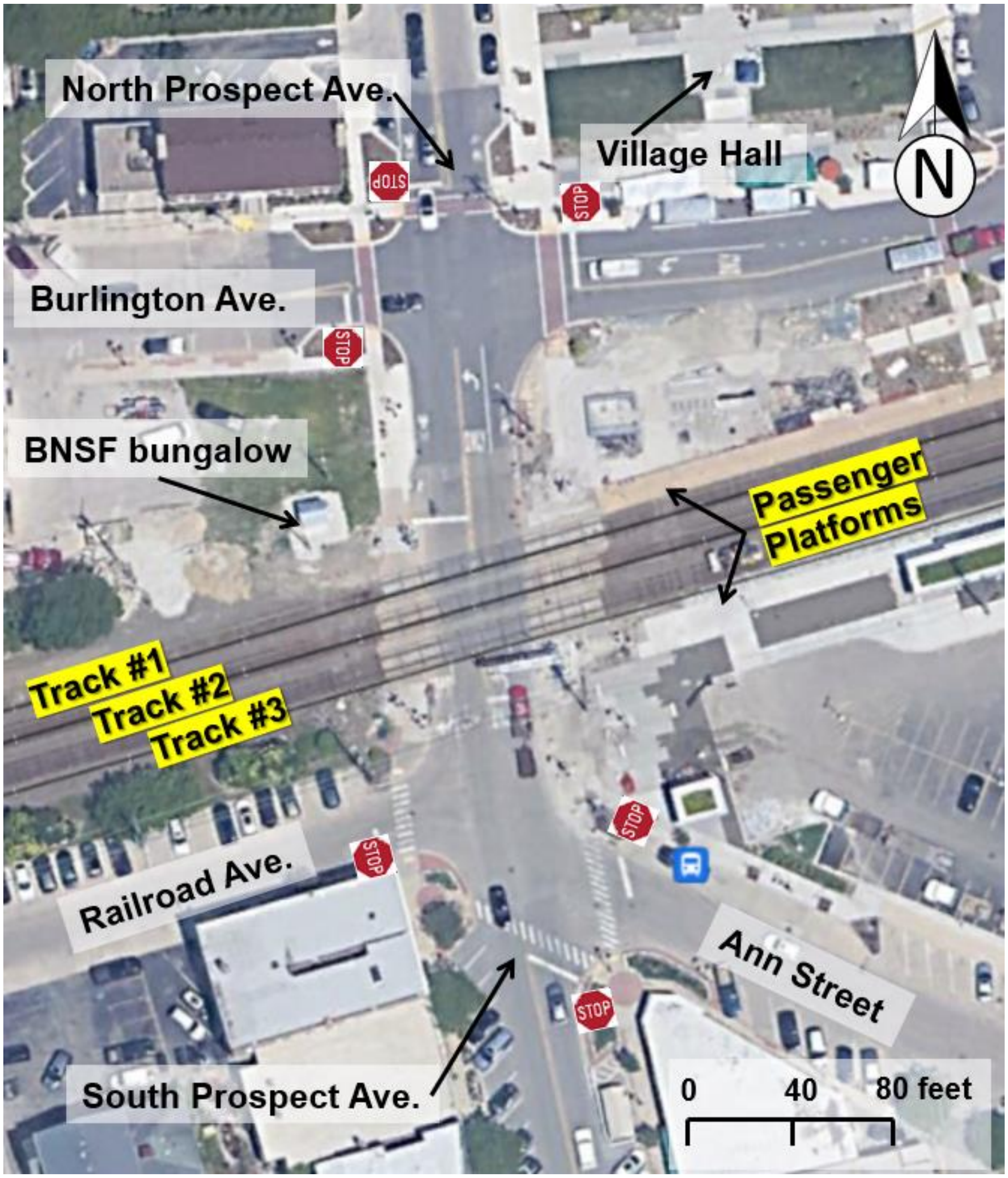

Figure 2 – Vicinity map of the Prospect Avenue and BNSF triple main grade crossing (Source: Google Earth revised, imagery date 4/24/2021).

3.0 Average Daily Rail Volumes

Table 1 summarizes the average daily rail volumes at the Prospect Avenue and BNSF triple main grade crossing. Passenger and freight trains run on all three tracks.[1] The passenger trains that run on Track #2 are express trains since no platform exists at the grade crossing between Tracks #1 and #3. Express trains also run on Tracks #1 and #3.

[1] The average daily rail volumes were provided by BNSF Railroad.

Table 1 - Average daily rail volumes.

Year	Passenger	Freight[2]	Total (Average per Day)
2022	79	33	112
2021	62	33	95
2020	50	33	83
2019	89	40	129
2018	88	42	130

4.0 Crash History at the Grade Crossing

Table 2 summarizes the crash history at the grade crossing.[3]

Table 2 - Crash history at the grade crossing.

Date	Time	Fatalities	Injured	Vehicle / Pedestrian / Bike
9-28-2017	7:55 a.m.	1	0	Pedestrian
5-11-1990	6:01 p.m.	0	0	Bike
2-14-1990	5:08 p.m.	0	0	Truck
6-13-1988	6:35 p.m.	0	1	Bike
7-30-1976	12:03 p.m.	0	0	Bike
7-17-1976	2:36 p.m.	1	0	Pedestrian
11-27-1970	5:35 p.m.	0	0	Automobile
1-21-1964	2:25 p.m.	0	0	Pedestrian
8-6-1962	10:22 p.m.	0	0	Automobile

E. SIGNAL FACTORS

1.0 Grade Crossing Regulations and Industry Standards

FRA regulations specified a minimum warning time in Title 49, Code of Federal Regulations, Part 234.225, Activation of Warning Systems, which stated:

> *"A highway-rail grade crossing warning system shall be maintained to activate in accordance with the design of the warning system, but in no event shall it provide less than 20 seconds warning time before the grade crossing is occupied by rail traffic."*

[2] Freight volumes consist of coal, agriculture, industrial products, consumer products, and foreign products.
[3] Source Illinois Commerce Commission, [Crossing Collision History (illinois.gov)](), accessed on March 17, 2023.

The 2009 edition of the MUTCD recommended national uniformity in traffic control devices. In order to provide for uniformity, MUTCD was the adopted national standard for traffic control devices. The MUTCD provided guidance through its recommended standards regarding flashing light units, gates and traffic control signals.

The AREMA, Communication and Signal Manual of Recommended Practices recommends the addition of buffer times and equipment response times to the warning time to accommodate assurance of providing the minimum required warning time.

2.0 Description of Signal System - BNSF Chicago Subdivision

The Chicago Subdivision[4] extends from MP 0.8 Roosevelt Road to MP 40.2 Montgomery in a timetable east-west direction. The subdivision consists of as much as 6 main tracks. Maximum authorized timetable speed is 60 mph for freight trains and 79 mph for passenger trains. The maximum speed for passenger trains in the accident location is 70 mph.

In the vicinity of the accident area, the BNSF authorizes train movements with a Centralized Traffic Control (CTC). Train movements are coordinated by the DS36 train dispatcher located at the Dispatch Center in Fort Worth, TX. Train movements on the Chicago's Subdivision are governed by operating rules, special instructions, timetable instructions, and the signal indications of the traffic control system.

The signal system uses DC Track Circuits on the rail that is interfaced with an ElectroLogix coded circuit transmitted over fiber optic for train occupancy detection. Wayside signals are colorlight signals with upper and lower signal heads capable of displaying green, yellow, and red aspects for train movements in either direction.

The BNSF centralized traffic control system was not affected, nor did it sustain any damage as a result of the collision.

3.0 Highway-Rail Grade Crossing Warning System

The BNSF triple main track runs through the Village of Clarendon Hills, Illinois. At MP 18.32, the BNSF three main tracks and the three lane Prospect Avenue roadway crossed at grade.[5] At the crossing, Prospect Avenue consists of one southbound lane and two northbound lanes. The grade crossing inventory number was DOT # 079529S. The highway-rail grade crossing was equipped with an active grade crossing warning system. This grade crossing warning system consisted of nine twelve-inch flashing LED light units, four warning bells, and two fiberglass gate arms mounted on two signal

[4] Chicago Division Timetable No. 2, effective October 6th, 2021 (Updated 2/22/22).
[5] Prospect Avenue had a posted speed limit of 25 mph.

masts and arranged to provide warning for all directions of highway traffic. Each gate arm was equipped with three four-inch LED lights and extended across incoming lanes of Prospect Avenue to the centerline for each direction of traffic. Two of the nine pairs of twelve-inch flashing LED light units are located on a cantilever located over the northbound lanes in advance of the crossing. A pair of twelve-inch flashing LED side-lights were also mounted on the upright portion of the cantilever aimed towards the west approach of Railroad Avenue. Railroad Avenue essentially parallels the tracks, just south of the crossing and extends to the west from Prospect Avenue. The warning system also consisted of four fiberglass pedestrian gate arms mounted on four signal masts and arranged to provide warning for all directions of pedestrian traffic. The gate arms extended across each incoming sidewalk of Prospect Avenue for each direction of pedestrian traffic.

The grade crossing warning system operated on commercial electric power and was equipped with a standby battery backup system.

Train detection and warning system activation was configured through an Alstom Grade Crossing Predictor (GCP), model XP-4, microprocessor unit. The crossing was equipped with a primary and standby GCP unit. Each GCP unit was configured in a bi-directional mode. The GCP unit was a constant warning device and could calculate the speed of an approaching train. The GCP unit provided a relatively uniform warning time, but the time could fluctuate slightly due to changing ballast and track conditions or variances in the speed of an approaching train. The warning devices were configured to provide a minimum warning time of 20 seconds required by the Federal Railroad Administration (FRA) and recommended by the Manual on Uniform Traffic Control Devices (MUTCD) for all train speeds up to 79 mph.[6] The BNSF standard design for crossings with automatic warning devices was 20 seconds of warning time plus 4 Seconds clearance time for wide or angled crossings and an additional 10 second buffer time for speed change and ballast conditions for a total signal design time of 34 seconds. The 14 seconds of clearance time and buffer time was included to provide a margin of safety to ensure that in no event should the crossing provide less than 20 seconds warning time for the normal operation of through trains before the grade crossing is occupied by rail traffic as required by the FRA.

3.1 Highway-Rail Grade Crossing Warning System Data Logs

The GCP unit at the Prospect Avenue crossing was equipped with a data logger. The data logger provided the capability to record information associated with the previous train movements through that location. The data log contained the date and time of train movements, the detected train speed,[7] the average train speed,[8] and

[6] Maximum train speed was limited to 70 mph as listed in the timetable.
[7] Train speed calculated by microprocessor to determine warning device activation time.
[8] Average speed of train as it traversed approach circuit.

island speed.[9] The log could also retain any error alarms detected by the microprocessor.

The data logs recorded the eastbound collision involved train, METRA train ID# A1242111S, activating the Prospect Avenue grade crossing warning system at 8:17 am. The logs recorded the average train speed approaching the grade crossing at 69 mph and the warning devices activating for 35 seconds before the train occupied the island circuit.

The data log for the Prospect Street crossing contained multiple data log entries. A post-accident review of the data found all warning times to be in accordance with the minimum requirements.

Figure 3 illustrates the timeline of the crash location from the approximate time the truck stalled on the tracks.[10] The truck stalled approximately 48 seconds before impact. The crossing lights began to flash approximately 35 seconds before impact. The north gate was approximately horizontal 24 seconds before impact. The south gate was resting on top of the stalled truck. The data logs indicated that 35 seconds of warning time were provided, which is above the minimum warning time of 20 seconds required by the FRA standard and MUTCD.

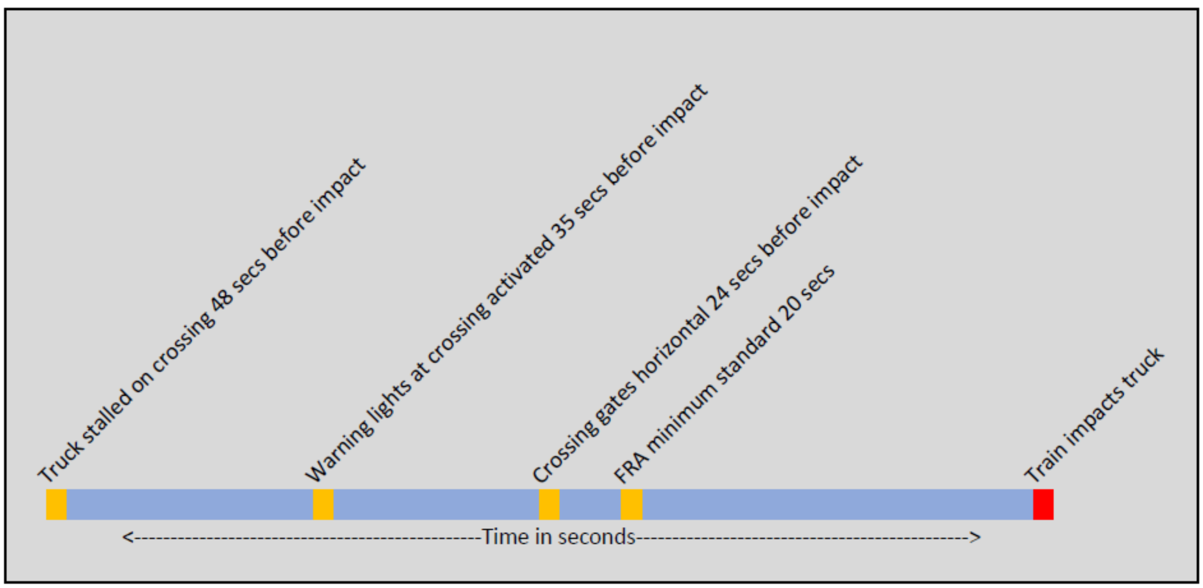

Figure 3 – Timeline of the crash location from the approximate time the truck stalled on the tracks.

[9] Train speed calculated by microprocessor as it enters the island circuit, typically in close proximity to edge of paved roadway.
[10] Based on security camera footage.

3.2 Inspection and Testing of Grade Crossing Warning System

Following the accident, BNSF secured the crossing signal bungalow. On May 12, 2022, representatives from the BNSF, the FRA, Brotherhood of Railroad Signalmen (BRS), Illinois Commerce Commission (ICC) and the NTSB began conducting a field inspection and investigation of the highway-rail grade crossing warning system at Prospect Avenue. The post-accident inspection of the grade crossing warning equipment, found the signal bungalow and all flashing light units locked and secured with no evidence of vandalism or tampering.

3.2.1 Track Circuits

Track components and connections were inspected, and the approach track circuits were verified. Approach track circuits extended from the Prospect Avenue crossing in both track directions. The eastbound and westbound approach track circuit lengths were configured in the GCP HXP4 unit at 3,901 feet for train speeds up to 70 mph, and in accordance with the signal circuit plans for that location. A train moving at a constant 70 mph would travel 3,901 feet in 38 seconds.

$$\left(\frac{1\ hour}{70\ Miles}\right)\left(\frac{1\ mile}{5280\ feet}\right)\left(\frac{3600\ seconds}{1\ hour}\right)(3901\ feet) = 38\ seconds$$

Trains moving at less than 70 mph would take additional time to travel the distances of the approach track circuits.

3.2.2 GCP Microprocessor Unit

The signal circuit plans for the Prospect Avenue grade crossing determined the GCP unit was configured to provide a minimum 20 seconds of warning time activation, and as noted previously the BNSF also added 14 seconds of clearance time and buffer time.

The post-accident inspection found the Prospect Avenue grade crossing warning system to be operating on the normal segment of the GCP unit that is equipped with a normal and standby section. If an issue were to be detected with the normal portion of the GCP it would automatically switch to the standby section to attempt to recover from the problem issue. The clock time of the GCP unit was verified with the BNSF Dispatch Center clock. The GCP unit clock was ahead of the Dispatch Center time by 2 minutes. The program configuration of the GCP microprocessor was recorded and verified against the programming parameters on file by FRA inspectors during the investigation. No discrepancies were identified in the programming parameters of the GCP unit.

3.2.3 Gate Arms

The southeast gate mechanism and pedestrian mechanism were struck by the stalled truck, post impact with the train, and destroyed. Post-accident testing measured the start of the descent time for the northwest gate arms to be about 3 seconds after the flashing light units were activated. All remaining gate arms, including pedestrian, assumed a horizontal position approximately 10 seconds after the flashing light units were activated.

3.2.4 Flashing Light Units

Post-accident insulation resistance tests were completed for the lighting cables from the signal bungalow to the signal masts. Testing determined the flashing light units were operating at 57 flashes per minute[11]. Lamp voltage measurements were taken with the warning devices operating on primary commercial power and on the standby battery backup system. Lighting circuit voltages on the southeast signal Cantilever mast measured 12.8 volts DC. Lighting circuit voltages on the northwest signal mast measured 12.98 volts DC. All voltage readings fell within FRA standards.

3.2.5 Overhead Cantilever Flashing Beacon Structure

An overhead cantilever flashing beacon structure existed over the northbound approach to the grade crossing. The Illinois Commerce Commission recommends overhead cantilever flashing beacon structures be constructed on multi-lane approaches to a grade crossing. The grade crossing consisted of 2-lanes in the northbound direction and 1-lane in the southbound direction.

3.3 Railroad Traffic Control Signal System Damage

The BNSF, highway-rail grade crossing warning system sustained heavy damage to the southeast highway and pedestrian gate mechanisms as a result of the accident. Both the highway and pedestrian gate mechanisms were equipped with breakaway[12] bases at the bottom of each signal mast that complied with AREMA standards.[13] Repair damages were estimated at $40,000.

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[11] CFR 234.217(c) - All light units shall flash alternately. The number of flashes per minute for each light unit shall be 35 minimum and 65 maximum.
[12] *Breakaway* is a design feature that allows a sign, luminaire, or pole top mounted traffic signal support to yield, fracture, or separate near ground level on impact.
[13] AREMA Standard 3.1.36 Recommended functional guidelines for configuration plans for highway-rail grade crossing warning devices.

F. HIGHWAY FACTORS

1.0 Geometry, Signing, and Peak Hourly Volumes near the Grade Crossing

Figure 4 illustrates the geometry, signing, and peak hourly volumes near the grade crossing. Free flow operation existed in the northbound direction at the intersection of North Prospect Avenue and Burlington Avenue.[14] The northbound direction consisted of left turn peak hourly volumes of 65 vehicles and thru-right turn peak hourly volumes of 340 vehicles.[15] Stop signs existed at the other 3 quadrants of the intersection. In addition, free flow operation existed in the southbound direction at the intersections of South Prospect Avenue and Ann Street/Railroad Avenue with peak hourly volumes of 225 vehicles. The free flow operation helped to avoid queuing and back-up of vehicles on the grade crossing.

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[14] *Free flow operation* means an unhindered flowing system in which motorists do not stop.
[15] See Signal and Highway Factors Attachment – Peak Hourly Traffic Volumes.

Figure 4 – Geometry, signing, and peak hourly volumes near the grade crossing (Source: Google Earth revised, imagery date 4/24/2021).

2.0 Village of Clarendon Hills Streetscape and Paving Improvements

The yellow highlighted area in **Figure 5** illustrates the plan view of the Village of Clarendon Hills streetscape and paving improvements in the vicinity of the grade crossing.[16] The project was approximately 95% complete at the time of the crash. Items remaining to be completed included final paving, pavement markings, crosswalks, and manhole frame adjustments. The profile view of Prospect Avenue in **Figure 6** illustrates the roadway grade leading up to the crossing at the south and north ends.

[16] See Signal and Highway Factors Attachment – Village of Clarendon Hills Streetscape and Paving Plans.

The roadway grade leading up to the south end of the grade crossing was approximately a positive 6 percent grade. The red lines shown in **Figures 5 and 6** indicate locations where vertical drop-offs existed that ranged from approximately 1.5-inches to 2-inches. The American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets recommends the surface of the roadway should not be more than 3 inches lower than the top of the nearest rail at a point 30 feet from the rail as shown in **Figure 6**.[17] No low ground clearance signs were used at the grade crossing because all overweight/oversize loads require a permit from the Village of Clarendon Hills. All overweight/oversize loads are directed to use the Village of Clarendon Hills Truck Route as shown in **Figure 9** that illustrates a grade separation of the IL 83 and BNSF triple main track.

[17] A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials (AASHTO), page 9-160.

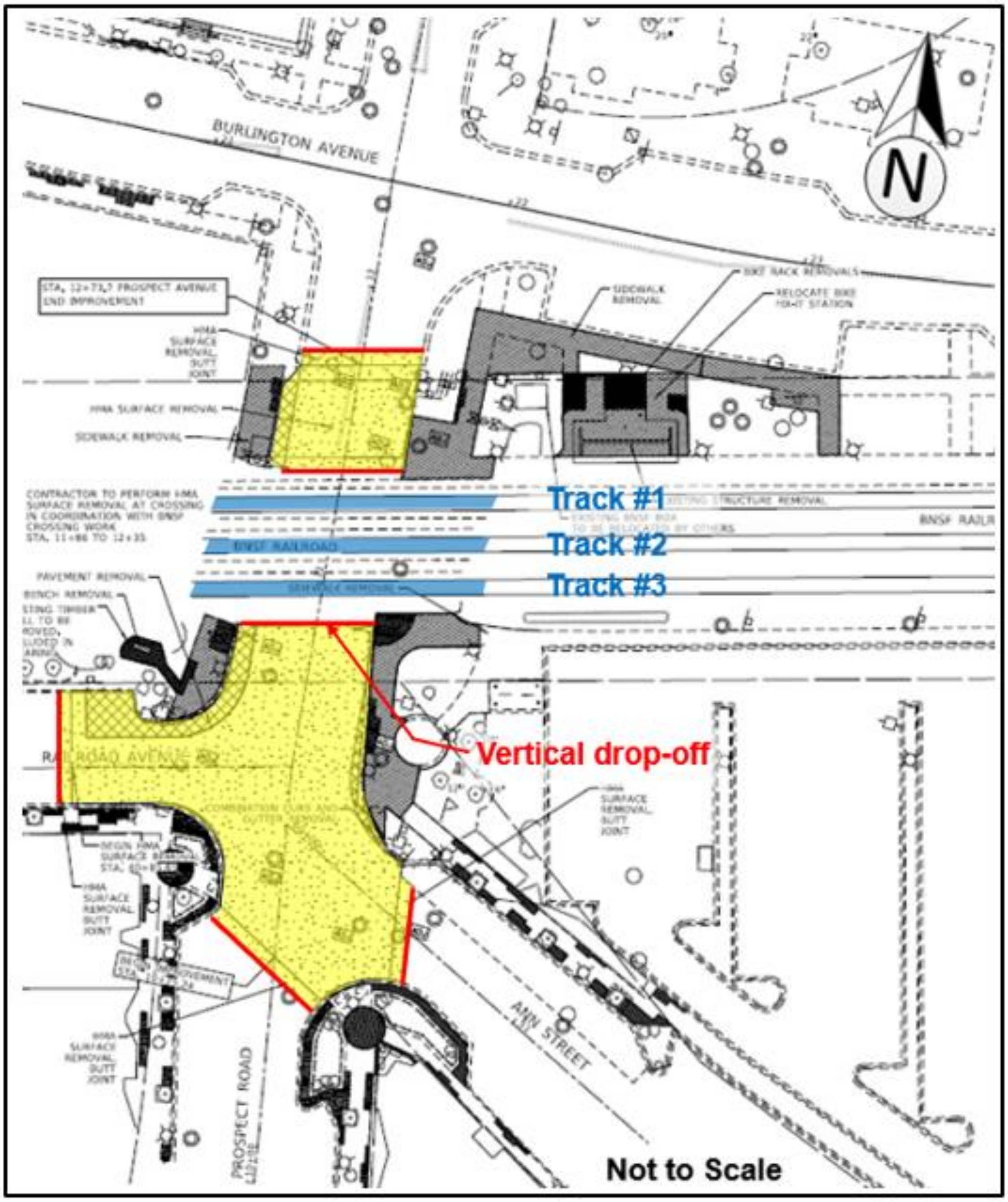

Figure 5 – Plan view of Village of Clarendon Hills streetscape and paving improvements (Source: Village of Clarendon Hills revised).

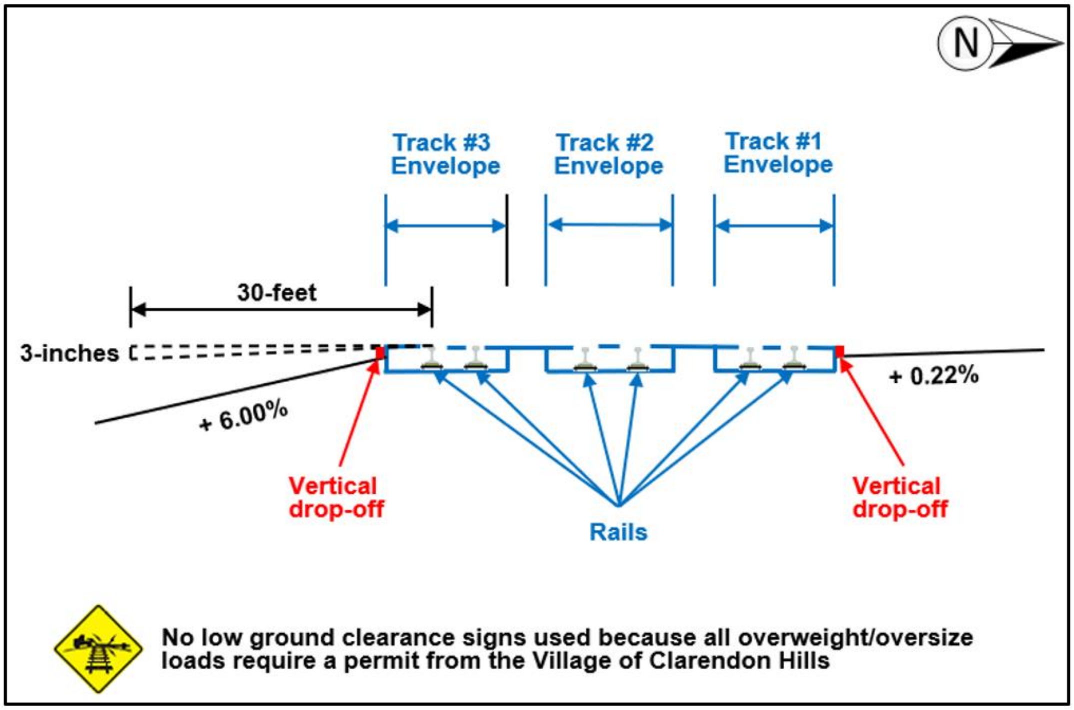

Figure 6 – Profile view of Prospect Avenue.

3.0 Vertical Drop-Off at South End of the Grade Crossing

The photograph to the left, **Photograph 1**, illustrates a vertical drop-off at the south end of the grade crossing in the northbound direction that was approximately 1.5-inches. The photograph to the right, **Photograph 2**, illustrates a "bump" sign which existed at the time of the crash warning drivers of the vertical drop-off in the northbound direction. The Illinois Department of Transportation (IDOT) standard for vertical drop-offs are included in the IDOT Standard Specifications.[18]

[18] See Signal and Highway Factors Attachment – Drop Off from IDOT Standard Specifications.

Photographs 1 and 2 – Vertical drop-off at the south end of the grade crossing in the northbound direction (Source: Illinois Commerce Commission).

4.0 Tapered Joint Plan

The illustration to the left of **Figure 7** shows the location of tapered joints on the streetscape and paving improvements plans.[19] A tapered joint, as shown in the upper right portion of **Figure 7**, is a temporary ramp constructed and maintained at both the upstream and downstream ends of the surface removal areas.[20] No tapered joints were constructed in the vicinity of the grade crossing or at the locations shown on the streetscape and paving improvements plans at the time of the crash. A tapered joint is typically removed, as shown in the lower right portion of **Figure 7**, immediately before the application of the hot mix asphalt surface.

[19] See Signal and Highway Factors Attachment – Tapered Joint Plan and Detail.

[20] See Signal and Highway Factors Attachment – Tapered Joint from IDOT Standard Specifications

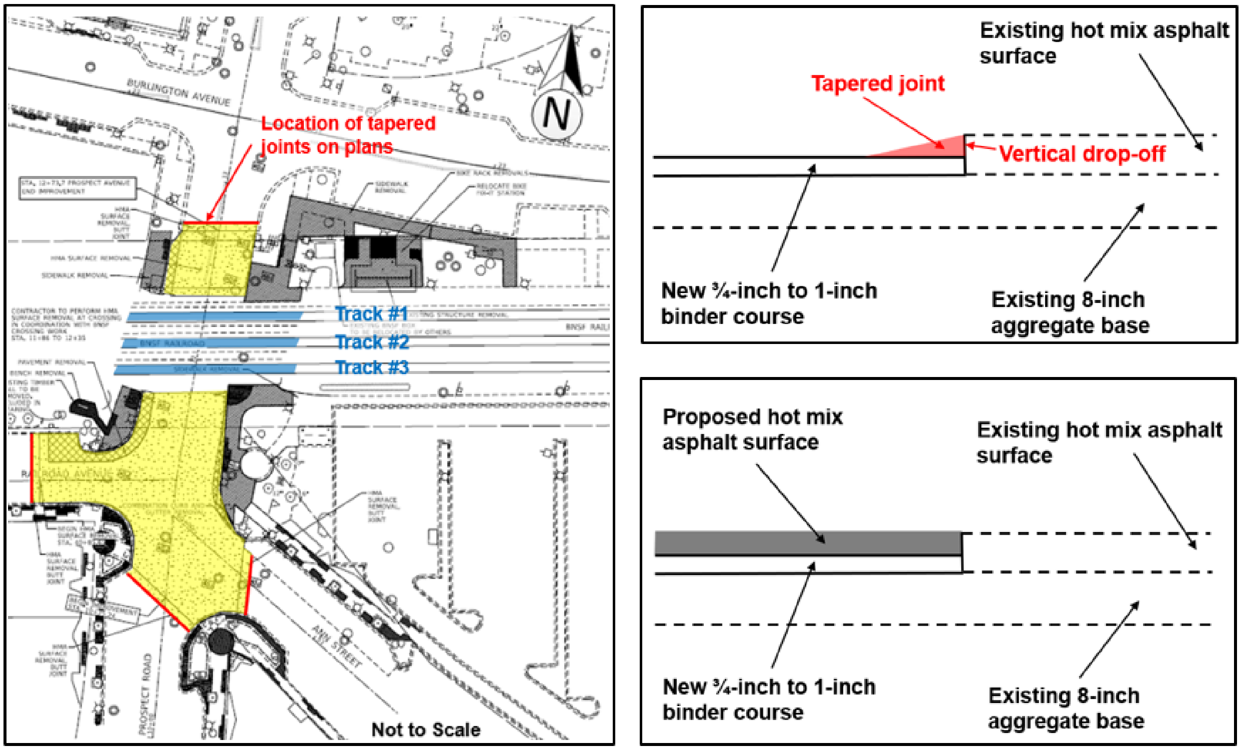

Figure 7 – Location of tapered joints on the streetscape and paving improvements plans (Source: Village of Clarendon Hills revised).

4.1 Responsibilities under the contract

The responsibilities under the contract for the streetscape and paving improvements were the following:

Resident Engineer (Terra Engineering) – The resident engineer's role was to be the Village's representative overseeing the day-to-day construction activities of the general contractor and their sub-contractors. The resident engineer determined if work was acceptable or needed to be redone. The resident engineer confirmed if the project was being built in accordance with the approved plans. The resident engineer worked to resolve plan set versus field condition conflicts with the contractor and alerted employees of John Burns Construction Company and R.W. Dunteman Company to any needed change orders. The resident engineer kept track of work and material quantities and prepared the pay approvals for submission to the Illinois Department of Transportation (IDOT). The resident engineer provided construction observation, including traffic control and advised the contractor if the traffic control was unacceptable. The resident engineer responded to local resident or business concerns related to the project. The resident engineer-maintained project records and daily logs of the construction.

General Contractor (John Burns Construction Company) – John Burns Construction Company was the general contractor who was awarded the contract for the outbound train station and related improvements which included the resurfacing of Prospect Avenue between Burlington Avenue and Ann Street. The outbound train station was the contract awarded by the IDOT. Separately, John Burns Construction Company was awarded a contract by the Village of Clarendon Hills to build the inbound train station and warming shelters, parking lot improvements and landscaping. As part of the IDOT contract, John Burns Construction Company hired R.W. Dunteman Company to complete the paving portion of the contract.

Paving Sub-Contractor (R.W. Dunteman Company) – R.W. Dunteman Company was hired by John Burns Construction Company to complete the grinding off of the old pavement, to place the binder (base) course of asphalt and to install the surface (top) course of asphalt. In-between placement of the binder course and the surface course, John Burns Construction Company performed the adjustments to manholes to bring them to final grade.

4.2 Resident engineer who inspected construction

The resident engineer from Terra Engineering indicated the following in a letter to the Village of Clarendon Hills dated May 19, 2022:[21]

> *"On 4/29/2022, I inspected the HMA binder work on site at around 12:30 to 1:00 p.m. After the binder paving was completed and after a long discussion with both the contractor Steven Volz of John Burns and the paving crew foreman of R.W. Dunteman Co. on how to grind the area close to the track, I requested that butt* [tapered] *joints be installed along both sides of the track. I had to leave the job site to go to another site before they concluded their work. I made it clear several times that I requested the butt* [tapered] *joint to be installed along both sides of track and the area between the end of sidewalks and the track (four corners) because it could be a tripping hazard and I was informed that the work would be completed as requested."*

4.3 Verification of conversation between resident engineer and general contractor and paving sub-contractor

The contractor of John Burns Construction Company indicated the following in an email to NTSB investigators dated August 9, 2022:[22]

> *"…Steve Volz did not have a conversation with Mustafa Shaikh of Terra Engineering on April 29, 2022 regarding construction of butt* [tapered] *joints. Mr. Volz was on-site and part of a conversation on April 27, 2022,*

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[21] See Signal and Highway Factors Attachment – Letter from Resident Engineer dated 5-19-22.
[22] See Signal and Highway Factors Attachment – Email from Attorney representing John Burns Construction Company to NTSB Investigators dated 8-9-22.

between himself, Mustafa Shaikh of Terra Engineering, and Mohammed Yousef of R.W. Dunteman, but that conversation involved reminding Dunteman that its scope of work included grinding (milling) the old asphalt all the way up to the existing railway crossing panels so that new binding and asphalt could be installed up to the panels (Dunteman expressed concern that the milling might damage the panels). Technically speaking, this is not a "butt [tapered] *joint" because it is not an asphalt-to-asphalt joint. At the time of the aforementioned April 27th conversation, Dunteman was still milling existing pavement at the site. Dunteman had not yet started installation of any of the binder course for the project or the milling of the area immediately adjacent to the railway panels (i.e., the area referred to in this request as a "butt* [tapered] *joint")."*

The paving crew foreman of R.W. Dunteman indicated the following in an email to NTSB investigators dated July 28, 2022:[23]

"I wasn't on the site as you are referring below on the April 29th, 2022."

5.0 Improvements Immediately after the Crash

Photograph 3 illustrates the Village of Clarendon Hills improvement immediately after the crash on May 13, 2022, to the south end of the grade crossing in the northbound direction. The Village constructed tapered joints at the south and north ends of the grade crossing and at all locations shown on the streetscape and paving improvements plans.

[23] See Signal and Highway Factors Attachment – Email from R.W. Dunteman to NTSB Investigators dated 7-28-22.

Photograph 3 – Photograph taken immediately after the contractor completed the construction of the tapered joint along the entire length of the south end of the grade crossing on May 13, 2022.

6.0 Four Quad Gate Conceptual Drawing

Figure 8 illustrates the Illinois Commerce Commission plans to install a four quad gate system at the grade crossing in the future. Although, the four quad gate system would not have prevented the crash, it does help to prevent vehicles from going around the gates once they have been lowered. The ICC's current standard for 4 quadrant gate installations requires dynamic operation, where a vehicle detection system is used to raise or keep exit gates up to allow vehicles to exit the crossing. The current ICC standard utilizes in pavement inductive loop detectors as the vehicle detection system. The ICC is continuing the evaluation of radar technology as either a potential adjunct or alternative to inductive loop detectors. Pending further evaluation and system performance of the radar, the ICC will continue its evaluation based on the following studies:

- FRA sponsored report entitled A Radar Vehicle Detection System for Four-Quadrant Gate Warning Systems and Blocked Crossing Detection.[24]
- Illinois Center for Transportation, University of Illinois at Urbana-Champaign, Field Evaluation of Smart Sensor Vehicle Detectors at Railroad Grade Crossings – Volume 4: Performance in Adverse Weather Conditions.[25]

The concrete pedestals for the exit gates and radar poles have been poured for the four quad gate system as part of the Village of Clarendon Hills streetscape and paving improvements project.

[24] See Signal and Highway Factors Attachment – Radar Vehicle Detection System.
[25] See Signal and Highway Factors Attachment – Field Evaluation of Smart Sensor Vehicle Detectors.

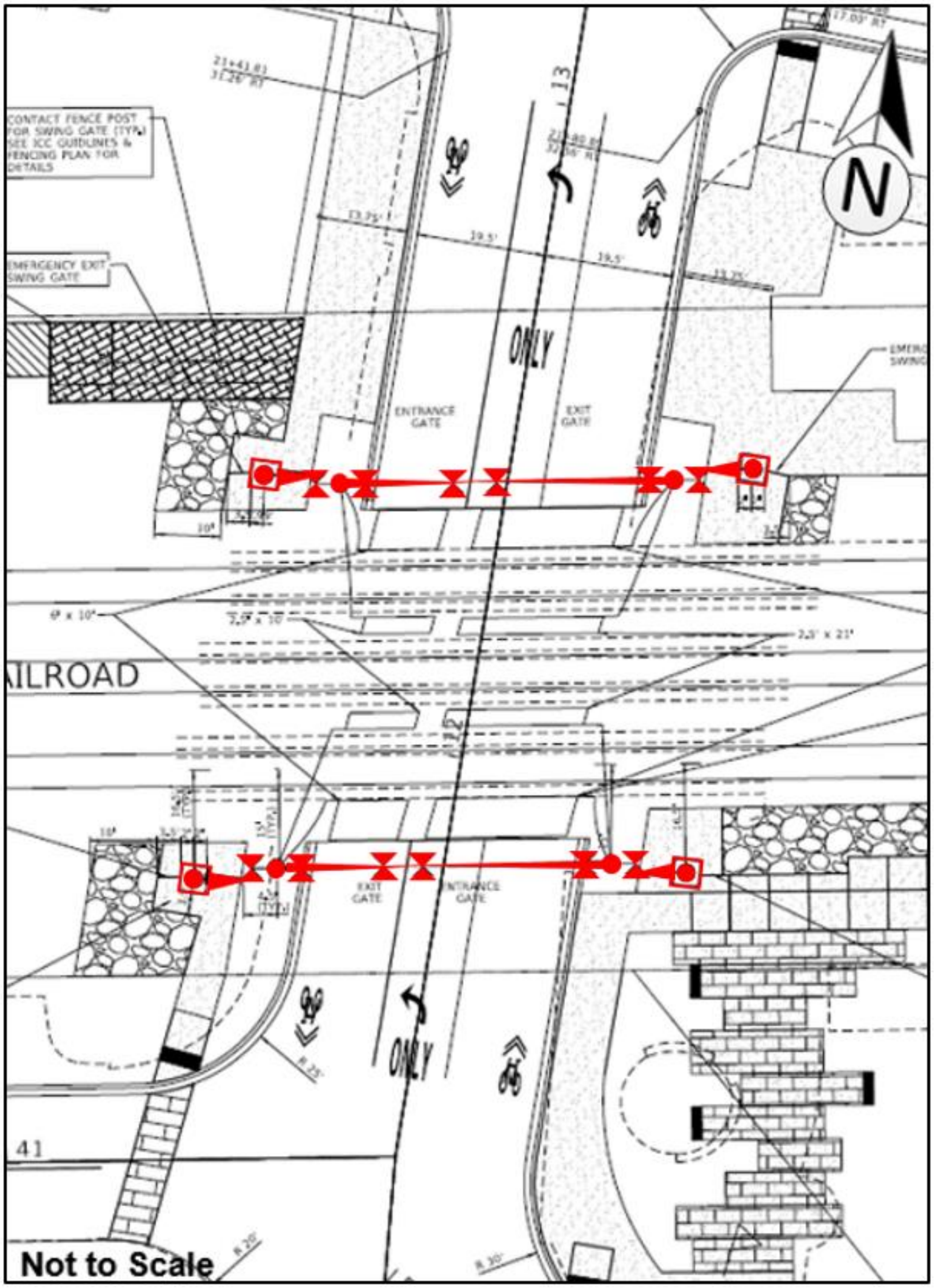

Figure 8 – Illinois Commerce Commission plans to install a four quad gate system at the grade crossing in the future (Source: Illinois Commerce Commission revised).

7.0 Village of Clarendon Hills designated truck route map

Figure 9 illustrates the Village of Clarendon Hills municipality border, designated truck routes, and route taken by the truck involved in the crash.[26] The Village of Clarendon Hills indicated the following in an email to NTSB investigators.[27]

"***Chapter 50 – Overweight Vehicles***[28]

> *Any vehicle licensed to operate with a gross vehicle weight (GVW) greater than sixteen thousand (16,000) pounds or with a manufacturer gross vehicle weight rating (GVWR) greater than sixteen thousand (16,000) pounds making a delivery or pick up in the Village must enter and exit the Village from a Village designated truck route. A vehicle may leave the truck route in order to make a delivery or pick up when the most direct route is used.*"

The truck involved in the crash had a manufactured gross vehicle weight rating of 33,000 pounds and did enter the Village of Clarendon Hills on a designated truck route, 55th Street. The truck did leave the designated truck route to make a pickup on Tuttle Avenue using the most direct route. The driver of the truck used a GPS device to determine the most direct route which directed him west on 55th Street to South Prospect Avenue. At that point, the driver turned right on South Prospect Avenue which led to the grade crossing.

The route provided by the GPS did not contemplate designated truck routes. As a result, the driver was in violation of Chapter 50 when he left 55th Street to South Prospect Avenue. Village regulations require any vehicle, which is greater than 16,000 pounds or rated greater than 16,000 pounds making a delivery or pick up in the Village to use the most direct route from the closest nonrestricted street to the particular delivery or pick up site.[29] 55th Street to South Prospect Avenue was not the most direct route to the Tuttle Avenue destination. To be in compliance with Chapter 50, the most direct route, from the closest nonrestricted street, would be to access Tuttle Avenue from Chicago Avenue. The destination was less than one block from Chicago Avenue, a nonrestricted street in the Village of Clarendon Hills.

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[26] See Signal and Highway Factors Attachment – Village of Clarendon Hills Truck Route Map and Ordinance.

[27] Email from the Village of Clarendon Hills to NTSB investigators dated June 6, 2022.

[28] Village Code of Clarendon Hills, Illinois, Chapter 50 Overweight Vehicles.

[29] A nonrestricted street is also referred to as a designated truck route.

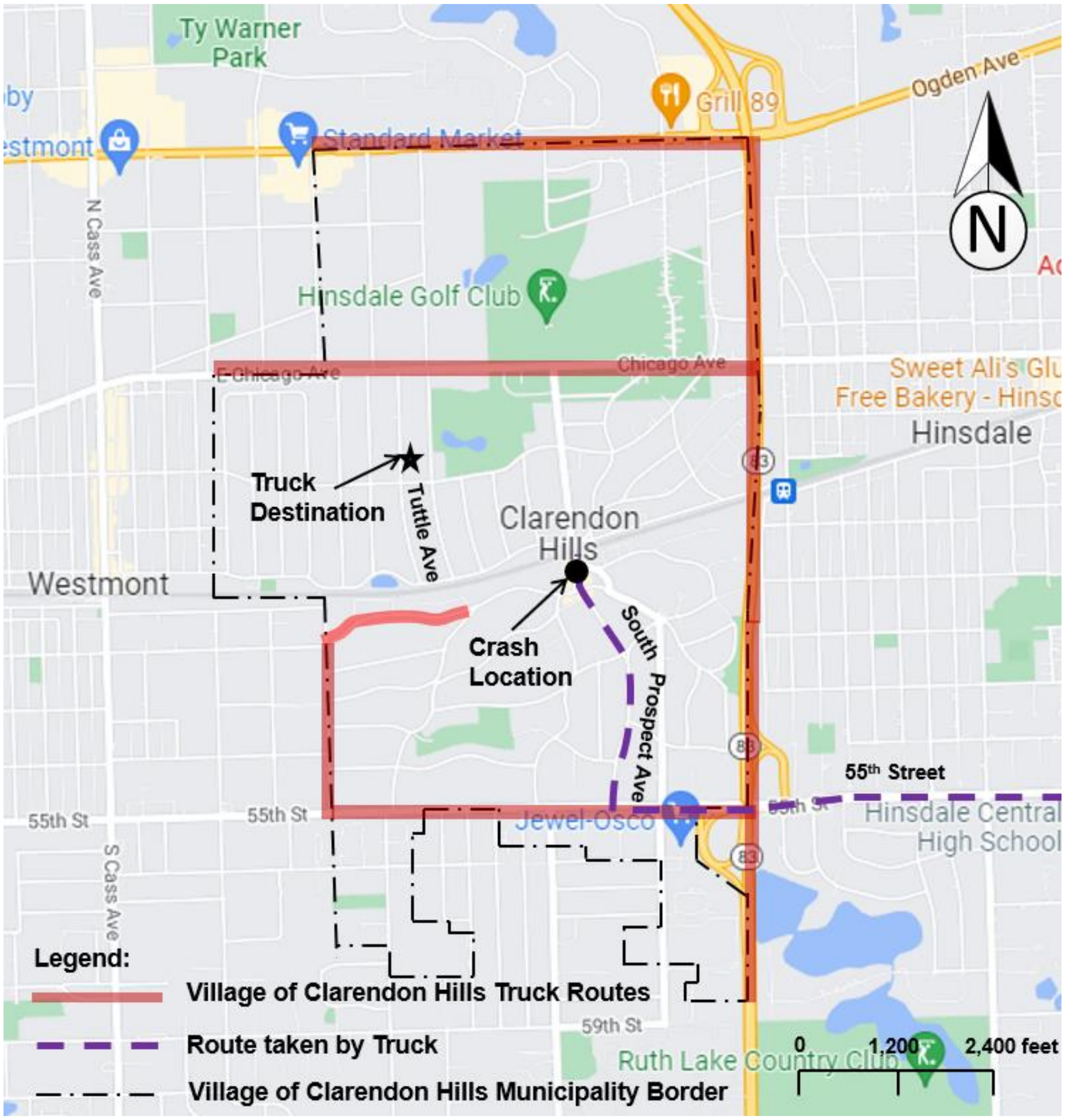

Figure 9 – Village of Clarendon Hills municipality border, designated truck routes, and route taken by the truck involved in the crash (Source: Google Maps revised).

APPENDIX A

The following attachments and photographs are included in the docket for this investigation:

LIST OF ATTACHMENTS

Signal and Highway Factors Attachment – Peak Hourly Traffic Volumes

Signal and Highway Factors Attachment – Village of Clarendon Hills Streetscape and Paving Plans

Signal and Highway Factors Attachment – Drop Off from IDOT Standard Specifications

Signal and Highway Factors Attachment – Tapered Joint Plan and Detail

Signal and Highway Factors Attachment – Tapered Joint from IDOT Standard Specifications

Signal and Highway Factors Attachment – Letter from Resident Engineer dated 5-19-22

Signal and Highway Factors Attachment – Email from Attorney representing John Burns Construction Company to NTSB Investigators dated 8-9-22

Signal and Highway Factors Attachment – Email from R.W. Dunteman to NTSB Investigators dated 7-28-22

Signal and Highway Factors Attachment – Radar Vehicle Detection System

Signal and Highway Factors Attachment – Field Evaluation of Smart Sensor Vehicle Detectors

Signal and Highway Factors Attachment – Village of Clarendon Hills Truck Route Map and Ordinance

LIST OF PHOTOGRAPHS

Signal and Highway Factors Photo 1 – View of vertical drop-off at the south end of the grade crossing in the northbound direction that was approximately 1.5-inches (Source: Illinois Commerce Commission)

Signal and Highway Factors Photo 2 – View of "bump" sign circled in red which existed at the time of the crash warning drivers of the vertical drop-off in the northbound direction and "Emergency 1-800" number circled in red mounted to vertical mast arm supporting flashing beacons (Source: Illinois Commerce Commission)

Signal and Highway Factors Photo 3 – View of "bump" sign circled in red which existed at the time of the crash warning drivers of the vertical drop-off in the northbound direction

Signal and Highway Factors Photo 4 – View of Track #3 looking in the eastbound direction west of the grade crossing with METRA train located in the background circled in red

Signal and Highway Factors Photo 5 – View of Track #3 looking in the eastbound direction west of the grade crossing with final rest of truck located to the right circled in red and METRA train located in the background circled in red

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Signal and Highway Factors Photo 7 – View of concrete pedestal circled in red for the southeast gate arm mechanism that was destroyed as a result of the crash looking to the west

Signal and Highway Factors Photo 8 – View of concrete pedestals circled in red for the pedestrian arm mechanism located in the foreground and the southeast gate arm mechanism located in the background that were destroyed as a result of the crash looking to the west

Signal and Highway Factors Photo 9 – View of northbound direction on Prospect Avenue approach to grade crossing illustrating vertical drop-off at the south end of the grade crossing and direction of truck once it was struck by the METRA train

Signal and Highway Factors Photo 10 – Another view of northbound direction on Prospect Avenue approach to grade crossing illustrating vertical drop-off at the south end of the grade crossing

Signal and Highway Factors Photo 11 – Another view of northbound direction on Prospect Avenue approach to grade crossing illustrating vertical drop-off at the south end of the grade crossing looking to the northeast

Signal and Highway Factors Photo 12 – Another view of northbound direction on Prospect Avenue approach to grade crossing illustrating vertical drop-off at the south end of the grade crossing looking to the northwest

Signal and Highway Factors Photo 13 – View of north end of the grade crossing illustrating the paving sub-contractor had grinded the old asphalt all the way up to existing railroad crossing panel

Signal and Highway Factors Photo 14 – View of northern limits of binder paving on Prospect Avenue illustrating vertical drop-off looking to the east

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Signal and Highway Factors Photo 16 – View of tapered joint constructed immediately after the crash along the south end of the grade crossing looking to the west

Signal and Highway Factors Photo 17 – View of tapered joint constructed immediately after the crash along the southern limits of binder paving on Prospect Avenue looking to the west

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Signal and Highway Factors Photo 21 – View of tapered joints constructed immediately after the crash along the northern limits of binder paving on Prospect Avenue in the foreground and along the north end of the grade crossing in the background looking to the south

Signal and Highway Factors Photo 22 – View of tapered joint constructed immediately after the crash along the south end of the grade crossing looking to the west on May 13, 2022

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